

Application No.: 10/619,224

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1-27. (Canceled)

28. (Withdrawn) An apparatus for mixing a fluid, the apparatus comprising:
a first substrate comprising a first inner surface functionalized with a microarray of reactive moieties;
a substantially parallel second substrate also comprising a second inner surface, wherein said first and second inner surfaces bound a closed chamber therebetween, said chamber adapted to retain a quantity of fluid so that the fluid is in contact with both surfaces;
at least one bubble disposed within said chamber; and
means for moving the chamber so that the bubble moves relative to the fluid to effect mixing of the fluid.

29. (Canceled)

30. (Withdrawn) The apparatus of claim 28, wherein the closed chamber has a thickness of less than about 2 millimeters.

31-33. (Canceled)

34. (Withdrawn) The apparatus of claim 28, wherein the bubble comprises a gas.

35. (Withdrawn) The apparatus of claim 28, wherein the bubble comprises nitrogen.

36. (Canceled)

37. (Withdrawn) The apparatus of claim 28, wherein the bubble is produced by introducing a volume of the fluid that is less than the total volume of the closed chamber.

38. (Withdrawn) The apparatus of claim 28, further including a flexible seal between the

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inner surface of the first substrate and the inner surface of the second substrate.

39-41. (Canceled)

42. (Withdrawn) The apparatus of claim 28, further comprising means for introducing fluid into the closed chamber.

43. (Canceled)

44. (Withdrawn) The apparatus of claim 28, wherein the first substrate and the second substrate are individually comprised of a material selected from the group consisting of glass, silicon, fused silica, plastic, and a combination thereof.

45. (Canceled)

46. (Withdrawn) The apparatus of claim 28, wherein the first substrate is comprised of glass.

47. (Canceled)

48. (Withdrawn) The apparatus of claim 28, wherein the means for moving the bubble is selected from the group consisting of rotating the apparatus about an axis, rolling the apparatus, and reciprocally shaking the apparatus.

49. (Withdrawn) A method for mixing a fluid, comprising: providing an apparatus according to claim 28; introducing a fluid into the closed chamber; introducing a bubble within the fluid; and moving the bubble in the fluid to effect mixing of the fluid.

50. (Canceled)

51. (Withdrawn) A method for mixing a fluid, comprising: providing an apparatus according to claim 30; introducing a fluid into the closed chamber; introducing a bubble within the fluid; and moving the bubble in the fluid to effect mixing of the fluid.

52. (Canceled)

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53. (Withdrawn) A method for mixing a fluid, comprising: providing an apparatus according to claim 36; introducing a fluid into the closed chamber, introducing a bubble within the fluid; and moving the bubble in the fluid to effect mixing of the fluid.

54. (Withdrawn) A method for mixing a fluid, comprising: providing an apparatus according to claim 48; introducing a fluid into the closed chamber, introducing a bubble within the fluid; and moving the bubble in the fluid to effect mixing of the fluid.

55-65. (Canceled)

66. (Original) A method comprising: providing a first substrate and a second substrate having inner surfaces that define a closed chamber therebetween, said chamber adapted to retain a quantity of fluid so that the fluid is in contact with both inner surfaces, and wherein at least one of said inner surfaces is functionalized with polynucleotides, polypeptides, or polysaccharides;

introducing a fluid containing a plurality of components into the closed chamber so as to provide a quantity of fluid therein in contact with both inner surfaces;

providing a bubble in the fluid; and

moving a bubble within the fluid to result in mixing.

67. (Original) A method according to claim 66, wherein the polynucleotide is a polyribonucleotide.

68. (Original) A method according to claim 66, wherein the chamber is adapted to retain a film of fluid in contact with both inner surfaces.

69. (Original) A method according to claim 66 wherein the inner surfaces of the first and second substrates are substantially parallel.

70. (Original) A method according to claim 66, wherein the chamber is less than two millimeters in thickness.

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71-72. (Canceled)

73. (Original) A method of claim 66, wherein the at least one of said inner surfaces is functionalized with polynucleotides.

74. (Original) A method of 66, wherein the at least one of said inner surfaces is functionalized with polypeptides.

75. (Original) A method comprising:

providing a first substrate and a second substrate having inner surfaces that define a closed chamber therebetween, said chamber adapted to retain a quantity of fluid so that the fluid is in contact with both inner surfaces, and wherein at least one of said inner surfaces is functionalized with an array of RNA or DNA probes;

introducing a fluid sample containing DNA or RNA into the closed chamber so as to provide a quantity of fluid therein in contact with both inner surfaces;

providing a bubble in the fluid;

moving a bubble within the fluid to result in mixing;

after hybridization is complete, removing the sample from the apparatus; and

analyzing the functionalized inner surface for DNA or RNA that has hybridized.

76. (Original) A method according to claim 75 additionally comprising heating the DNA or RNA containing sample fluid while in the closed chamber.

77. (Original) A method according to claim 76 additionally comprising washing the functionalized inner surface prior to the analyzing.

78. (Original) A method according to claim 75, wherein the bubble is moved in a circular pattern.

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79-92. (Canceled)

93. (Withdrawn) An apparatus for mixing a fluid, the apparatus comprising:

a first substrate comprising a first inner surface functionalized with an array of reactive moieties;

a substantially parallel second substrate also comprising a second inner surface, wherein said first and second inner surfaces bound a closed chamber therebetween, said chamber adapted to retain a quantity of fluid so that the fluid is in contact with both surfaces;

at least one bubble disposed within said chamber; and

means for moving the chamber so that the bubble moves relative to the fluid to effect mixing of the fluid.

94. (Withdrawn) The apparatus of claim 93, wherein the closed chamber has a thickness of less than about 2 millimeters.

95. (Withdrawn) The apparatus of claim 93, wherein the bubble comprises a gas.

96. (Withdrawn) The apparatus of claim 93, wherein the bubble comprises a gas selected from the group consisting of air, nitrogen, argon, or oxygen.

97. (Withdrawn) The apparatus of claim 93, wherein the bubble is produced by introducing a volume of the fluid that is less than the total volume of the closed chamber.

98. (Withdrawn) The apparatus of claim 93, further including a flexible seal between the inner surface of the first substrate and the inner surface of the second substrate.

99. (Withdrawn) The apparatus of claim 93, further comprising means for introducing fluid into the closed chamber.

100. (Withdrawn) The apparatus of claim 93, wherein the first substrate and the second substrate are individually comprised of a material selected from the group consisting of

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glass, silicon, fused silica, plastic, ceramic, and metal, and a combination thereof.

101. (Withdrawn) The apparatus of claim 93, wherein the first substrate and the second substrate are individually comprised of glass.

102. (Withdrawn) The apparatus of claim 93, wherein the means for moving the bubble is selected from the group consisting of rotating the apparatus about an axis, rolling the apparatus, and reciprocally shaking the apparatus.

103. (Withdrawn) A method for mixing a fluid, comprising: providing an apparatus according to claim 93, introducing a fluid into the closed chamber; introducing a bubble within the fluid; and moving the bubble in the fluid to effect mixing of the fluid.

104. (Withdrawn) A method for mixing a fluid, comprising: providing an apparatus according to claim 94; introducing a fluid into the closed chamber; introducing a bubble within the fluid; and moving the bubble in the fluid to effect mixing of the fluid.

105. (Withdrawn) A method for mixing a fluid, comprising: providing an apparatus according to claim 95; introducing a fluid into the closed chamber; introducing a bubble within the fluid; and moving the bubble in the fluid to effect mixing of the fluid.

106. (Withdrawn) A method for mixing a fluid, comprising: providing an apparatus according to claim 102; introducing a fluid into the closed chamber; introducing a bubble within the fluid; and moving the bubble in the fluid to effect mixing of the fluid.

107. (New) A method comprising: providing first and second substrates and a seal; placing the second substrate on top of the seal and first substrate so as to define a closed chamber therebetween, said chamber adapted to retain a quantity of fluid so that the fluid is in contact with both inner surfaces, and wherein at least one of said inner surfaces is functionalized with polynucleotides, polypeptides, or polysaccharides; and introducing a fluid containing a plurality of components into the closed chamber so as to provide a quantity of fluid therein in contact with both inner surfaces.

108. (New) A method according to claim 107 wherein the polynucleotide is a

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polyribonucleotide.

109. (New) A method according to claim 107 wherein the chamber is adapted to retain a film of fluid in contact with both inner surfaces.

110. (New) A method according to claim 109 wherein the chamber is up to several millimeters in thickness.

111. (New) A method according to claim 110 wherein the inner surfaces of the first and second substrates are substantially parallel.

112. (New) A method according to claim 110 wherein the chamber is up to three millimeters in thickness.

113. (New) A method according to claim 112 wherein the chamber is up to two millimeters in thickness.

114. (New) A method according to claim 107 wherein the fluid is introduced into the closed chamber by first introducing the fluid onto the first substrate carrying the seal then placing the second substrate on top of the seal.

115. (New) A method according to claim 107 wherein the seal is attached to the first substrate.

116. (New) A method according to claim 107 wherein the inner surfaces of the first substrate is functionalized with the polynucleotides, polypeptides, or the polysaccharides.

117. (New) A method according to claim 107 wherein the inner surface of the second substrate is functionalized with the polynucleotides, polypeptides, or the polysaccharides.

118. (New) A method according to claim 107 wherein the inner surface of the first and second substrate is each functionalized with polynucleotides, polypeptides, or the polysaccharides.

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119. (New) A method according to claim 107 wherein one of the substrates has an opening for introducing fluid into the closed chamber.

120. (New) A method according to claim 107 wherein the seal has an opening for introducing fluid into the closed chamber.

121. (New) The method of claim 107 wherein the at least one of the inner surfaces is functionalized with polynucleotides.

122. (New) The method of 107 wherein the at least one of the inner surfaces is functionalized with polypeptides.

123. (New) An apparatus comprising first and second substrates and a seal, wherein the second substrate is positioned on top of the seal and first substrate so as to define a closed chamber therebetween, said chamber retaining a quantity of fluid therein so that the fluid is in contact with both inner surfaces, and wherein at least one of said inner surfaces is functionalized with polynucleotides, polypeptides, or polysaccharides.

124. (New) An apparatus method according to claim 123 wherein the chamber is up to several millimeters in thickness.

125. (New) An apparatus according to claim 124 wherein the inner surfaces of the first and second substrates are substantially parallel.

126. (New) An apparatus according to claim 124 wherein the chamber is up to three millimeters in thickness.

127. (New) An apparatus according to claim 123 wherein the inner surface of the first and second substrate is each functionalized with polynucleotides, polypeptides, or the polysaccharides.

128. (New) An apparatus according to claim 123 wherein one of the substrates has an

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opening for introducing fluid into the closed chamber.

129. (New) An apparatus according to claim 123 wherein the seal has an opening for introducing fluid into the closed chamber.